# Wheel and Tire Tracking System (WATTS)
# 56 Equipment Maintenance Squadron,
# Luke AFB, Arizona

## Abstract

The mission of the 56th Equipment Maintenance Squadron (EMS) is "dedicated professionals providing quality maintenance, services, and products to customers through superior effort, continuous training, and teamwork." The Wheel and Tire Element has excelled at doing just that. Our primary customers include seven F-16 fighter squadrons assigned to the 56th Fighter Wing (FW), as well as transient aircrews and aircraft. The Wheel and Tire Element provides over 850 nose and main landing gear wheel and tire assemblies for 188 assigned F-16 aircraft Wheels are cycled through the shop and reissued to fighter squadron supply points at an average rate of 500 assemblies per month.

The Wheel and Tire Tracking System (WAITS) was established due to problems stemming from the inadvertent installation of the improper bearing in an F-16 wheel assembly. A natural working group was established to study, analyze, and improve the process. Bearing installation verification and wheel accountability was non-existent. Although mission requirements were being met, a serious breakdown in the process was evident. Had the wheel assembly with the improper bearing been installed on an aircraft, catastrophic results could have occurred. One assembly had already been identified with the wrong bearing. However, there was no process in place to determine if any other assemblies had the same problem, short of doing a time-consuming one-time inspection of all installed wheels. In addition, procedures were not in place to prevent a reoccurrence of the same problem.

The natural working group identified three key areas for improvement: (1) ensure proper bearing installation; (2) provide accountability for the installation of the bearing; and (3) develop positive tracking and control of assets. Improvement of these three processes in this order were essential to support the wing's flying mission, pilot safety, and reliable aircraft.

The group was empowered by the 56 EMS Maintenance Supervisor, with full support of the Commander, to utilize managerial and administrative functions and the leadership of the squadron Quality Council to expedite the seven-step improvement process as it pertained to wheel and tire assemblies. The team was given the decision-making power to establish a program on the merits of their expertise in the field of F-16 aircraft maintenance. The team fully expected to attain 100 percent customer satisfaction while establishing a tracking system to reduce excessive man-hours spent inspecting assemblies. The team envisioned a system that would ensure measurement, personnel accountability, and correct bearing installation, thus making the possibility of a mishap or interruption of the flying mission virtually impossible. Through such a tracking system, assets could be located at any point during the entire life cycle of the wheel assembly.

A task-level flow chart was developed to define the process. A cause and effect diagram, along with group discussions were utilized to identify boundaries. Using these tools, the team determined that several factors were outside of their span of control, but with the use of the cause and effect diagram, the team concluded that these factors were not an issue in this process.

Historical records, attrition rates, monthly stock counts, quality evaluation results, and supply records were used to identify possible root causes. The process flow chart and cause and effect diagram were also used. The team contacted other F-16 bases to determine if they had undergone any similar process improvement in this area. However, the other bases contacted did not have the same or a similar problem, which was a limiting factor. 'Me team also applied who, what, where, when, and why questions in targeting the root causes. They looked at each step of the process to determine who was involved, what they did, where they performed the actions, why the step was necessary, and when it occurred.

By using a cause and effect diagram, the team determined that the root cause of the problem was the non-verification of the correct bearing during installation. Verification of the part number is required by technical order at the time of wheel installation. Had this verification been accomplished, the wrong bearing would not have been installed. In addition, the element did not have a method of accounting for the individual who built each wheel assembly. Had such a method been in place, individual responsibility for each bearing installation would have existed.

'The group came up with several solutions to this problem at hand. The group created an action matrix which concluded that a supervisory follow-up inspection was the team's best solution to the bearing verification problem. The supervisor could inspect the bearing at any point in the process after installation, keeping the process flowing without interrupting workers performing maintenance. The team also decided to add more inspection points to the follow-up inspection and look for critical items prior to fire inflation. If a supervisor discovered a discrepancy in the wheel assembly or bearing, it could be repaired prior to tire inflation, saving up to 12 hours of downtime required for a leak check after inflation. Items selected for the inspection were those items most commonly identified as problems by the customer. By incorporating the inspection steps into an official, easy-to-use checklist, personnel were made immediately aware of all changes and revisions. Additionally, using a specific checklist, supervisors can accurately track defects and trends. Reports are tallied monthly, and workers are briefed on the results of the inspection, contributing to the solution of problems, and encouraging personnel to strive for continuous improvement.

The team determined that, since the wheel assemblies have serial numbers, accountability and tracking was within the boundaries of the process. The team also realized that a manual method for tracking 850 wheels would become cumbersome and time-consuming. A computer-generated data base was a possible answer; however, the problem of manually gathering data and inputting it into the data base still needed to be addressed. The development of a bar code tracking system which tied into the data base was the instrument the team decided to focus its energy on.

The team agreed on the bar code system as the most rapid and accurate way to gather and record data. By affixing a bar code label on each wheel assembly and coding it to the wheel serial

number, an instantaneous method of collecting data was established. Once the data was collected using a laser scanner, the information was downloaded into a user-friendly data base on a personal computer. The data base was built using a common software program that was acquired by the Squadron Computer Manager. The scanner package was locally purchased.

The team accomplished more than it envisioned. The process was named the Wheel And Tire Tracking System (WATTS). The simplicity and speed of the scanner and versatility of the data base is remarkable. Customers no longer sign hand receipts and log books; a bar code label represents each squadron. As the customer needs a wheel, the technician scans the wheel's bar code and the location bar code, and the customer takes the wheel. Daily production counts are automatically tallied and can be printed in daily, monthly, or yearly reports. Management information such as number of wheels on hand, wheels on order, depot wheels, and supply point balances is automatically reported as required. Information about each wheel, such as the date it was built, employee number of the technician who built it, and the supervisor who inspected the work, is easily retrieved. Also, location of wheel throughout the process can be input and recalled immediately Depot overhaul dates are automatically forecast up to 20 years in advance.

By examining metrics (control charts), the team was able to determine that defects on assembled wheels were reduced almost immediately by 50 percent, and continued to improve monthly. Within two months of the program's implementation, complete records of all wheels were stored in the data base. Wheels on order in Base Supply were reduced to less than 10 per type of assembly, a situation that has rarely occurred in past years. Man-hours spent inventorying wheels were greatly reduced, and supervisors no longer had to report to work early to count on-hand wheels and hand-print a daily status slide. Customer issue time was cut in half, as the customer no longer had to sign log books. Since implementation of WATTS, no wheels have been returned to the shop because of a defect that was due to our shop's repair cycle.

Equating the intangible benefits is difficult. Considering the potential for damage to an aircraft by a defective wheel assembly, this factor alone stands out as a significant dollar savings. The tangible benefits are more easily measured:

- 20 percent fewer man-hours are spent documenting and reporting wheel status
- Customer waiting time has been reduced by 50 percent
- After the first three months of implementation, the defect rate decreased by 95 percent.
- The customer benefits from this inspection by receiving an error free product
- The system provides for accurate tracking and wheel management
- Wheel status is immediately available upon demand
- The wheel forecast can anticipate supply point shortages up to 20 years in the future

The potential of this program is limitless. Complete and immediate accountability of assets can be accomplished for not only wheels but any traceable item. This team has only touched the surface of the possibilities of this program. The sense of ownership in this process has increased to a point where the workers are proud to put their signature on the end product. Our goal is to eventually stop using the supervisor inspection. Employees' pride of workmanship and "do it right the first time" attitude will eventually delete this layer of inspection. The team is still active,

continually exploring all new avenues and expanding the scope of this program's application for continuous process improvement.

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